

PROCESSING RECOMMENDATIONS
For Samtec's SEARAY™ (SEAM/SEAF Series) Vertical Connectors
Samtec SEARAY™ (SEAM/SEAF 系列)连接器 (垂直形) 制程建议

The method used to solder these high density connectors is the same as that used for many BGA devices. While BGA's have spherical solder balls attached to the leads, the SEARAY™ employs the unique solder charge design. 这种方法常用于焊接高密度的连接器，与用于BGA器件相似。BGA器件有锡球连到端子引线上，而SEARAY™使用独特的Solder Charge设计。

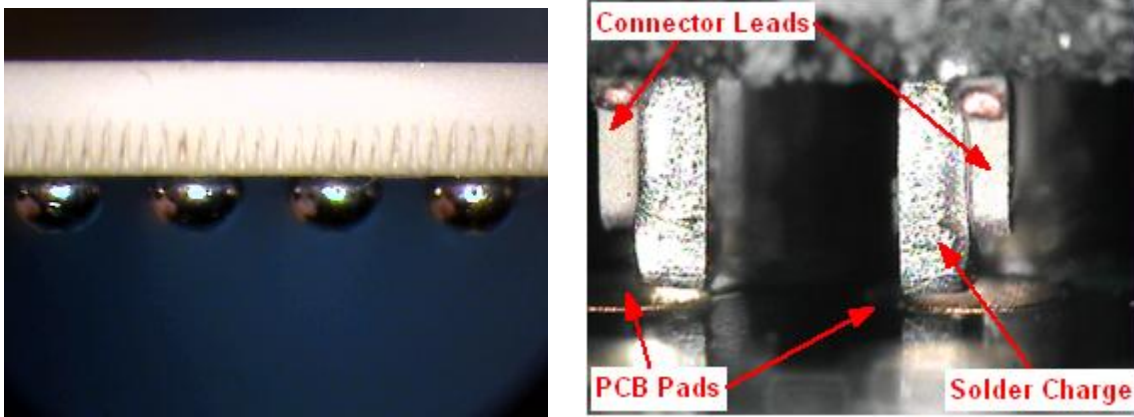


Fig. 1. Solder Balls on BGA's v. Solder Charges on SEARAY™.
BGA上锡球与Solder Charge 的对比

Another difference is that unlike the uniform grid arrangement of BGAs the solder charges are offset making the leads appear to be in pairs. The leads themselves are on a .050" x .050" pitch but because the lead orientation alternates from row to row, the solder charges are positioned back to back. 另一个不同是：Solder Charge不同于BGA的一般网状阵列，Solder Charge是偏移一定位置与连接器端子引线一起成对出现。由于连接器端子引线方向逐排交替变化，而使Solder Charge背靠背排列在连接器05" x .05"端子引线上。如Fig. 2所示。

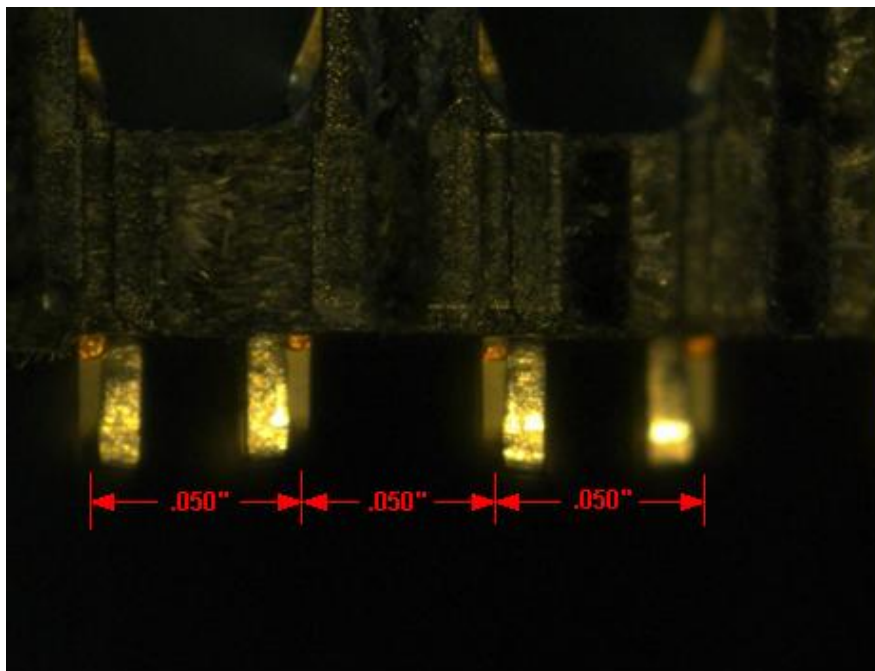


Fig. 2. Solder charge locations on adjacent rows – end view.
Solder Charge在邻排的位置

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These differences are minor however and customers will have success by following these simple guidelines: 尽管这些差异很小，但也需要客户遵从如下这些简单的指导方针才会取得成功：

1. **Basic Recommendations 基本推荐**

- *Minimum* stencil thickness to be .005" (0.13mm), 最小刷锡钢网厚度为 5mil(即 0.13mm)
- Follow our recommended footprints, found here: 使用我们推荐的 footprints，可以在下面连接中找到：
 - <http://www.samtec.com/documents/webfiles/cpdf/seam-xx-xx.x-xx-xx-x-xx-footprint.pdf>,
 - <http://www.samtec.com/documents/webfiles/cpdf/SEAF-XX-XX.X-XX-XX-X-A-XX-FOOTPRINT.pdf>

2. **Solder Screen Printing Process 刷锡制程**

- Complete solder pad coverage is critical. The recommended aperture size of .035" (0.89mm) is intentionally larger than the pad to ensure that the solder charge comes into contact with the solder paste. If this does not occur, proper wetting will not be achieved (see Fig. 3). Automated inspection of each print is recommended. If solder paste does not completely cover the solder pad the assembly should be rejected, cleaned and re-printed. 完全焊盘覆盖是极其重要的。推荐钢网网孔尺寸为 0.035" (0.89mm) 大于焊盘是有意设置的，以保证 Solder Charge 能插入并接触到锡膏。如果不能达到这些要求，就不能达到合适的回流效果（如图 Fig. 3）。推荐使用刷锡程序的自动检查步骤。如果锡膏不能完全覆盖焊盘，这次刷锡则应被拒绝，应清洁后重新刷锡。
- Stencil cleaning may need to be monitored more frequently to ensure complete solder pad coverage is maintained. 钢网需要经常清洗和检查，以保持连续的完全焊盘覆盖。

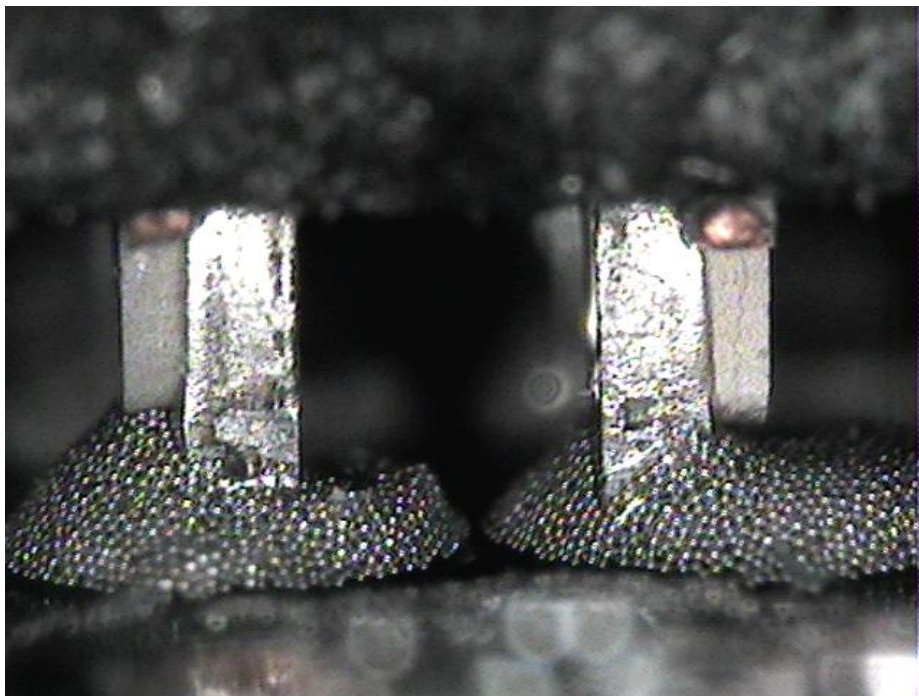


Fig. 3. Solder charge location relative to solder print. Notice good contact between solder charges and solder paste. Solder Charge相对于锡膏的位置。注意Solder Charge与锡膏的良好接触

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3. Component Placement 元件放置

- The connector must be fully seated. As previously stated and shown in **Fig. 3**, it is critical that the solder charge comes into contact with the solder paste to ensure proper wetting. When using automated pick and place equipment, ensure the Z-axis dimension fully seats the solder charges onto the board surface. Due to nominal variances in solder charge positioning, i.e., coplanarity, not all charges will contact the board at the same time. **Fig. 4** illustrates a fully seated connector prior to reflow.连接器必须完全放好，如前所述和 **Fig. 3** 所示。Solder Charge 插到带锡膏的触点处以保证正常回流是很重要的。当使用自动贴片设备时，要保证 Solder Charge 插到主板表面上的 Z 轴尺寸。由于 Solder Charge 的高度位置有差异，即共面，不是所有的 Solder Charge 要同时接触到主板上。**Fig. 4** 列举了一个回流前的 Solder Charge 位置。
- As the solder charges reflow, the weight of the connector causes it to settle so that the body rests on or slightly above the board after processing. This phenomenon is why the upper coplanarity specification of .009" (.22mm) is acceptable for the SEARAY™ connector family (see **Fig. 5** below).当 Solder Charge 回流时，连接器的重量使其下垂并安放在板上，从而在回流后连接器胶壳接触主板或与其间有很小缝隙。这种现象正说明了 SEARAY™ 系列产品共面度上限 0.009"(0.22mm)是可接受的。(见下面 **Fig. 5**)

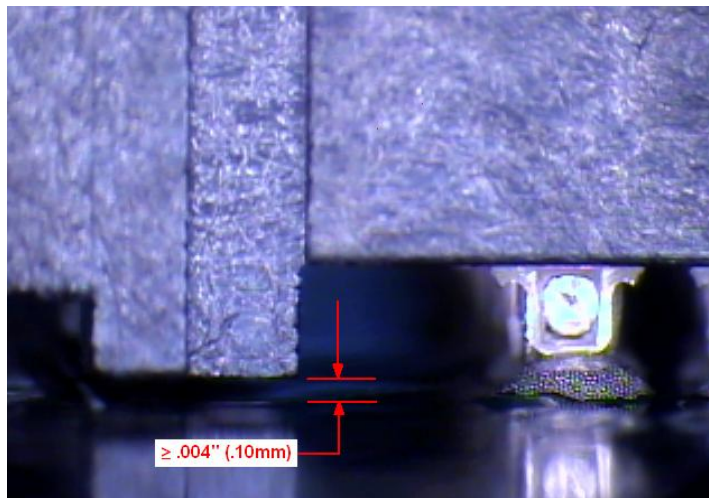


Fig. 4. The insulator housing of a fully seated SEARAY™ connector prior to reflow will rest approximately .004" (.10mm) above the board surface. SEARAY™连接器的绝缘胶壳在回流前与主板之间有约.004" (.10mm)缝隙

PROCESSING RECOMMENDATIONS

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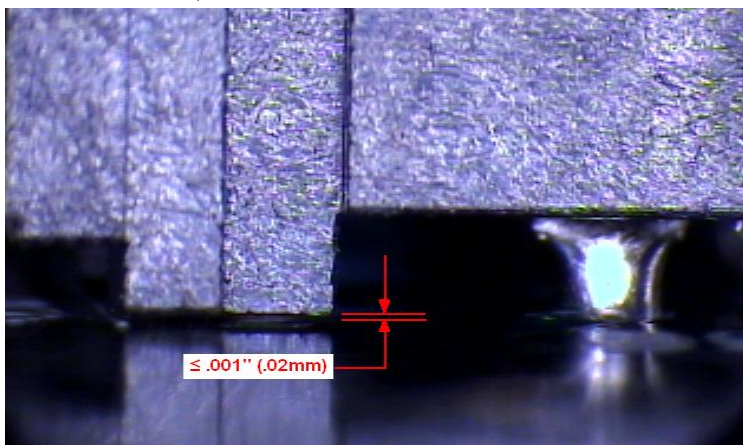


Fig. 5. The insulator housing of a reflowed SEARAY™ connector will rest on the board surface or slightly above. SEARAY™连接器的绝缘胶壳在回流后与主板之间没有或有一丝缝隙。

4. Proper Profiling 合适的回流条件

- Samtec strongly recommends the use of a low level oxygen environment (typically achieved through nitrogen gas infusion) in the reflow process to increase the wettability of the soldering surfaces. SEARAY™ testing has consistently shown a dramatic increase in solder yields in a low level oxygen environment as opposed to an air environment. Many variables affect the level of residual oxygen required to optimize a given reflow process, but generally the levels should be less than 1000 ppm. Samtec 强烈建议使用低氧环境回流 (一般可通过氮气的注入来实现) 来达到更好的回流效果。从我们对 SEARAY™ 系列产品的一系列测试中得出低氧环境相对有氧环境来说其回流品质的稳定性可以得到非常大的提高。许多因素决定了需要一定量的氧气来优化回流环境, 但一般的氧气含量应该要低于 1000ppm。
- The importance of properly profiling the fully populated printed circuit assembly cannot be overstated. The reflow process that forms the solder joint is sometimes overshadowed by other processes but is critical to ensuring the solder charge reaches proper reflow conditions. Certain components can be sensitive to time and temperature, so both variables must be controlled and a thermal profile must be performed prior to processing or production. Thermocouples should be placed as close to the solder charge as possible (**underneath the part**) in the center and on the outside edge (see **Fig. 6**). 不管怎样强调正确测量回流条件的重要性都不算过份。有时回流过程重要性被其它制程所影响, 但是保证 Solder Charge 达到适当的回流条件是极其重要的。一些器件对于温度和时间特别敏感, 因此在回流和生产前这两个变量必须受控制和做出温度曲线。热电偶探头应放置在连接器下方中心和边缘并尽量接近 Solder Charge。 (如 Fig. 6 所示)

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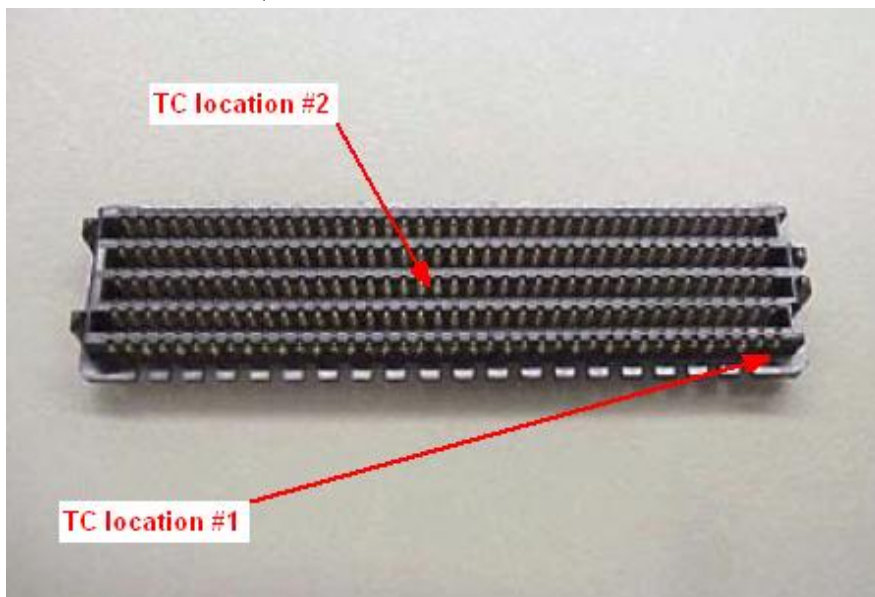


Fig. 6. Top side reference of thermocouple locations for reflow profiling. 做回流条件时热电偶放置参考位置。

Listed below are some profile recommendations for both Lead and Lead-Free reflow. Please note that these are only recommendations. Samtec strongly suggests that each customer perform their own reflow profile study prior to processing or production. 下面列举的是一些回流有铅和无铅产品而推荐使用的回流条件。请注意这些条件仅做参考。Samtec强烈建议在回流和生产前，每个客户根据自己用的锡膏类型研究并做出适用自身的回流条件。

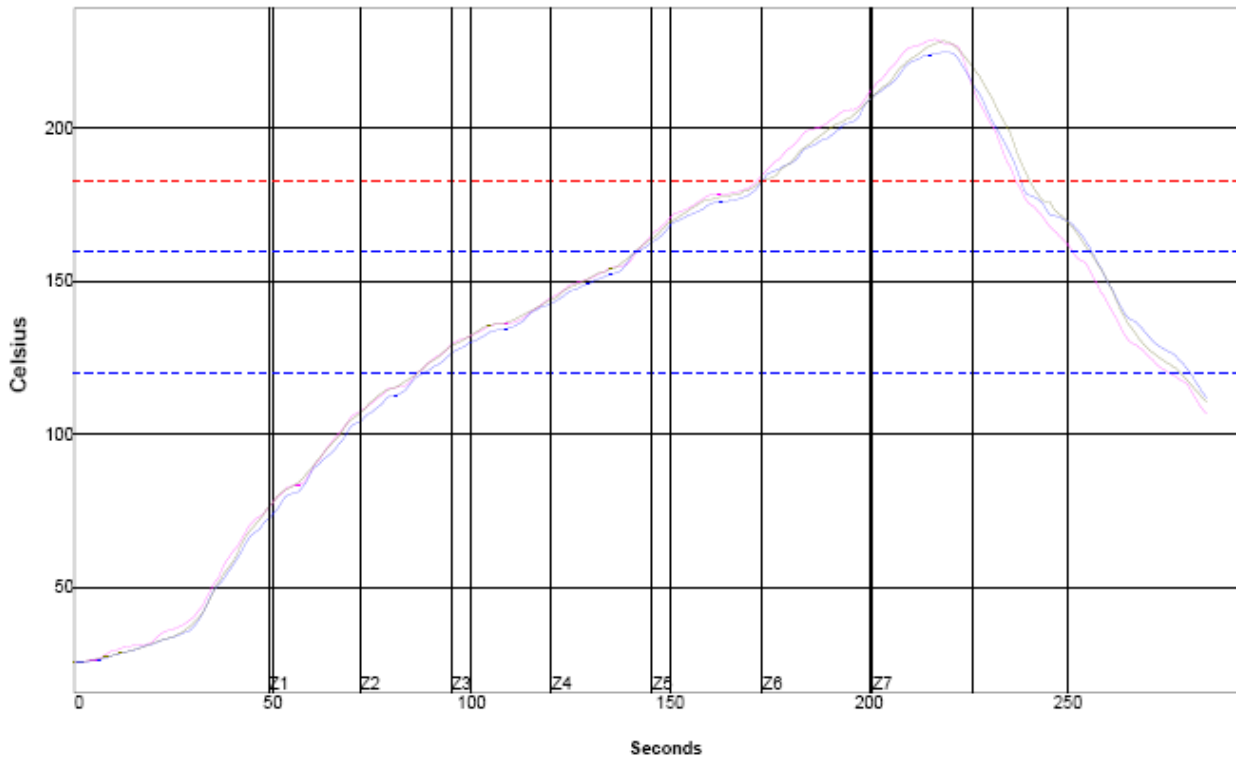
Lead (Sn63Pb37)有铅回流条件

- Max Rising Slope: Ramp up 1.5 - 2°C / second
- Soak: Soak at 120 - 160°C for 60 seconds
- Time Above Liquidous: 60 - 70 seconds
- Peak Temperature: 225 - 230°C

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Setpoints (Celsius)							
Zone	1	2	3	4	5	6	7
Top	110.0	140.0	155.0	170.0	205.0	230.0	265.0
Bottom	110.0	140.0	155.0	170.0	205.0	230.0	265.0

Conveyor Speed (inch/min): 28.00



	PWI= 119%	Max Rising Slope	Max Falling Slope	Soak Time 120-160C	Reflow Time /183C	Peak Temp
U19		1.89	-2.68	55.58	65.21	229.39
J9 Mid		1.85	-2.33	54.36	64.81	225.01
J9 Rear		1.99	-2.39	55.14	67.01	228.78
Delta		0.14	0.35	1.22	2.19	4.39

Fig. 7. Example of Lead (Sn63Pb37) - Straight Ramp Reflow Profile

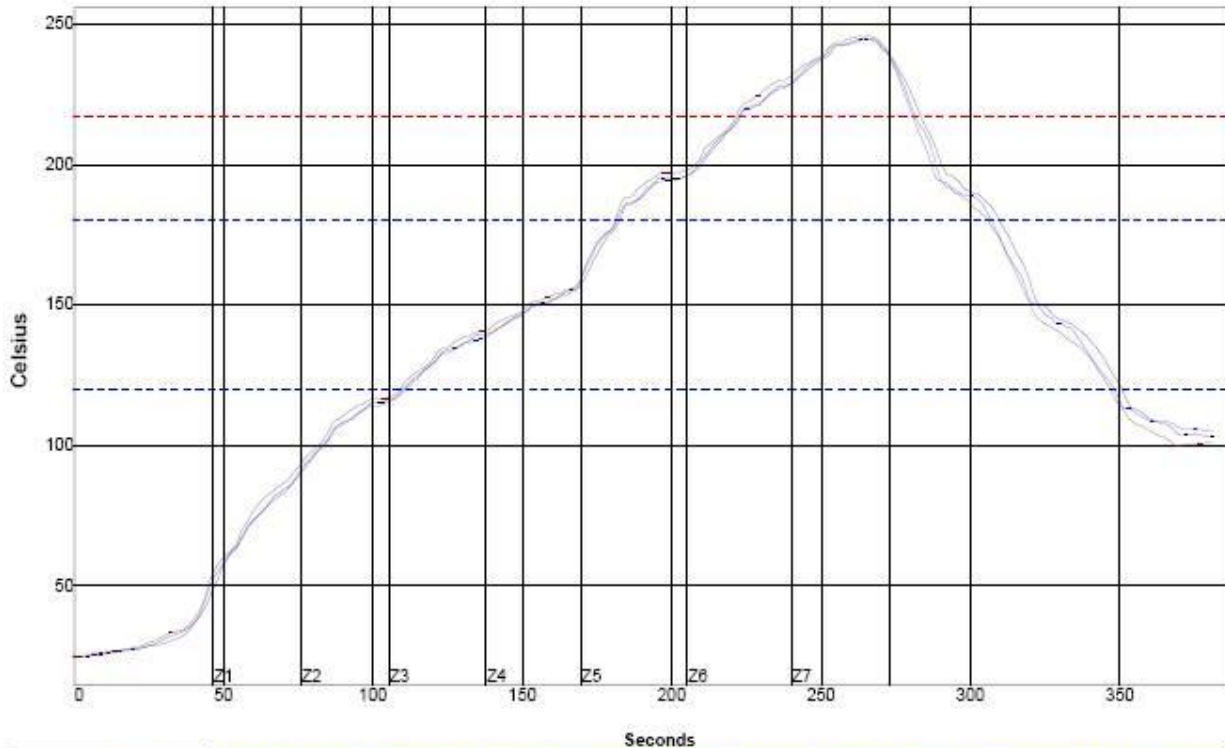
PROCESSING RECOMMENDATIONS
For Samtec's SEARAY™ (SEAM/SEAF Series) Vertical Connectors
Samtec SEARAY™ (SEAM/SEAF 系列)连接器 (垂直形) 制程建议

Lead-Free (Sn96.5 Ag3.0 Cu0.5)无铅回流条件

- Max Rising Slope: Ramp up 1.5 - 2°C / second
- Soak:
 - Straight ramp: 120 - 180°C for 70 seconds
 - Traditional Soak: 145 - 180°C for 80 - 90 seconds
- Time Above Liquidous: 60 - 70 seconds
- Peak Temperature: 240 – 245 °C

Setpoints (Celsius)							
Zone	1	2	3	4	5	6	7
Top	125.0	140.0	160.0	170.0	240.0	260.0	270.0
Bottom	125.0	140.0	160.0	170.0	240.0	260.0	270.0

Conveyor Speed (inch/min): 23.80



	Seconds									
	PWI= 59%	Max Rising Slope	Max Falling Slope	Soak Time 120-180C	Reflow Time /217C	Peak Temp				
Right In Right	1.85	14%	-2.44	-15%	71.73	-22%	58.28	-41%	244.70	47%
Left Out In	1.85	14%	-2.18	6%	71.71	-22%	60.46	-31%	244.90	49%
Left Out Out	1.93	24%	-2.47	-17%	72.05	-20%	60.18	-33%	245.89	59%
Delta	0.08	0.29	0.34	2.18	1.20					

Fig. 8. Example of Lead-Free (Sn96.5 Ag 3.0 Cu 0.5) - Straight Ramp

PROCESSING RECOMMENDATIONS
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Fig. 9. Example of Lead-Free (Sn96.5 Ag 3.0 Cu 0.5) – Traditional Soak

NOTE: One of the most common issues customers face during the initial profiling stage is inadequate heating of the solder charges. **Fig. 10** below is an example of how the solder charges appear when they have not reached proper reflow temperatures. Even though the leads touched the solder printed on the board the wetting was not sufficient to form a good joint. When this is the result, the profile must be adjusted until the solder joints look like those in **Fig. 11**.

说明：最普通的问题之一是在回流初始阶段，客户面临着对Solder Charge预热不足。如下面**Fig. 10**是一个当Solder Charge没有达到正常的回流温度而出现不良品的例子。即使端子引线接触到了板上的熔化锡，但这种回流不足以达到很好焊接。当出现这种不良时，回流条件必须调整，直到焊锡点如**Fig. 11**一样良好回流。

NOTE: When using SEARAY elevated connectors large temperature differences between the PCB and solder joints may occur. PCB composition and component types/layout may affect these differences.

说明：在使用 SEARAY™ 系列连接器的时候，PCB 与焊点的温度相差非常大的情况是可能发生的。因为 PCB 的构成及部件的类型/分布都可能会导致 PCB 与焊点的温度相差非常大。

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For Samtec's SEARAY™ (SEAM/SEAF Series) Vertical Connectors

Samtec SEARAY™ (SEAM/SEAF 系列)连接器 (垂直形) 制程建议

Rework Considerations 修正考虑

- Should rework be required, the method used will depend on the severity of the defect. Total connector replacement is accomplished using a Hot-Air rework system. For more information on this method, please see the application note found here: 如果产品回流不良而必须修正时，这种方法要视回流不良的程度而定。替换整个连接器可用热风修正机。用这种方法更多的信息请在下面这个路径中找到：
 - http://www.samtec.com/Documents/WebFiles/Current_Literature/rework_array_ch.pdf
- The defects shown in **Fig. 10** below occurred on the outer row of contacts and were reworked using a Hakko FR-802 Hot-Air Rework System and 4.4mm nozzle. The liquid water-soluble flux was applied with a brush at the defect sites and hot-air was introduced by moving the nozzle in a circular motion so as not to damage the connector or board. With the addition of flux and the already present solder, wetting easily occurs and the terminations are soldered. **Fig. 11** shows the same two joints after they were reworked using this method. 下面 **Fig. 10** 所示的不良出现在触点的外排，可使用 Hakko FR-802 热风修正机和 4.4mm 的风嘴进行修正。用一把刷子蘸水溶性松香到不良区域，用热风机风嘴沿不良区域圈状移动着吹以避免损坏接头和电路板。在松香的帮助下，已有锡点的不良区域很容易就被焊接好。**Fig. 11** 是 **Fig. 10** 用这种方法回流后的结果。

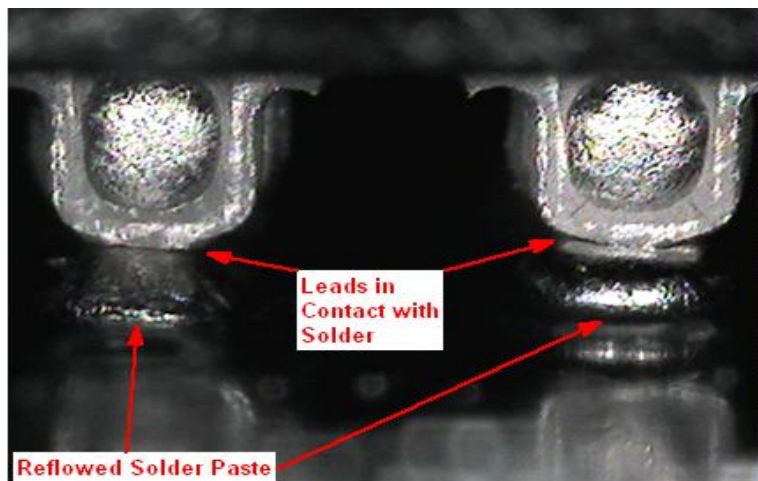


Fig. 10. Defective outer row solder joints. 外排不良焊锡点

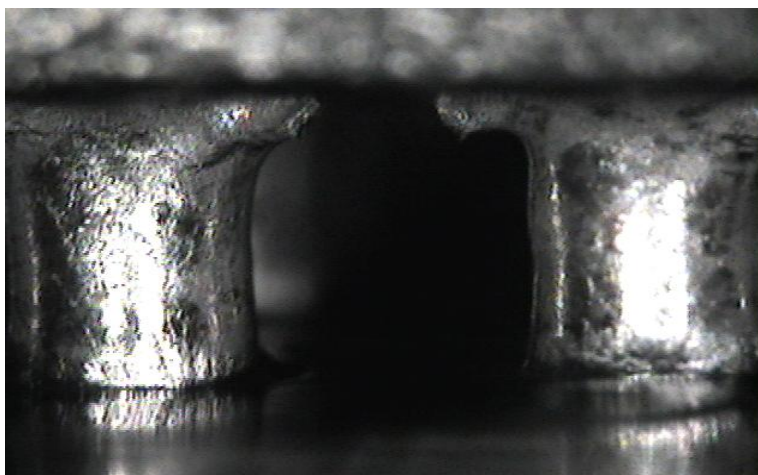


Fig. 11. Outer row solder joints from **Fig. 10** reworked using a hand held hot-air system. 修正后的外排焊锡点。

PROCESSING RECOMMENDATIONS
For Samtec's SEARAY™ (SEAM/SEAF Series) Vertical Connectors
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5. Handling 取放

- These connectors are typically packaged in trays or tape and reel which protect the solder charges from damage. They should be handled like any other BGA or IC device. 这种连接器的典型包装是用 tray 盘和卷盘包装，以避免 solder charge 被损坏。它们的取放应像其它的 BGA 或 IC 元器件一样小心。
 - Avoid resting the connector on the solder charges except during final placement onto the board,应避免接触连接器 Solder Charge，除非最终要将连接器放到主板上。
 - When using tape and reel packaging, ensure the bottom of the pocket is protected as it travels through the feeder,当用卷盘包装时，保证盘底经过进给器时受到保护。
 - Avoid touching the solder charges,应避免接触到 Solder Charge。
 - When a partially used tray needs to be stored, use the flat cover from the original shipment or an empty tray to cover connectors. Band trays using flex wrap or rubber bands.当部分产品需要用 tray 盘存放时，用一个平底盘垫底和一个空 tray 盘盖在连接器上，再用包装膜或橡皮筋系紧。

For further information or questions about anything in this document or processing questions about any Samtec connectors, please contact the Interconnect Processing Group at:

如果您对本文档内容和制程中所提及的有任何疑问或想知道更多有关于其他Samtec连接器的制程信息，请联系Interconnect Processing Group:

Phone(电话): 1 (800) SAMTEC9 or 1 (800) 726-8329

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